**REMAINDER AND FACTOR THEOREM**

1. **Remainder Theorem:** If a polynomial is divided by , then the remainder if .

Example: If we divide the polynomial by , then the remainder should be .

Proof:



1. **Factor Theorem:** If a polynomial is divided by , and the remainder is zero, i.e. , then is a factor of the polynomial.

Example:

Since , , and

Then , and are factors,

i.e

Delta Ex 26.2 pg 239 Q 1-4, extension Q5 - 11

1. **Factorising using the Factor Theorem**

Example: Factorise

* The cubic expression has three roots which are all factors of the constant term in the expression, i.e. 6.
* The factors of 6 are 1, 2, 3, 6 and -1, -2, -3, -6. These are the possible numbers to substitute into the factor theorem process (may use the TABLE function of your graphics calculator to quickly work out which substitutions give you a value of zero).

=> is a factor

=> is a factor

* Therefore , we can work out the final factor by inspection: must equal the constant term 6, so .
* Therefore

1. **Solving polynomial equations using the Factor Theorem**

Example: Solve the equation

* Find one factor first using the factor theorem on numbers such as 1, -1, 2, -2 etc.
* f(1) = 3(1)3 + 4(1)2 - 5(1) – 2 = 0 => is a factor
* If we divide the polynomial by the factor , we will end up with a quadratic which can be factorised in the usual way.



* Factorise
* So , and the solutions to the equation are .

Delta Ex 26.3 pg 243, Q 4-13, 21, 22. Extension: the rest.